

## ***Installing Your MM/1 Extended Kit***

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# Welcome

We at Interactive Media Systems are glad you chose to buy our MM/1 Personal Computer Kit. We're sure you will enjoy many hours of computing with the new and innovative capabilities of this machine. However, to insure trouble-free operation, please follow the instructions below carefully.

The IMS MM/1 Personal Computer Kit you have received was designed to use many existing industry standard parts to make it simpler for the user to install and expand. In addition, the computer's small size and low power requirements make it ideal for mounting in a wide variety of cases. The following instructions will help you in selecting the equipment you will need to install your new system, as well as a step-by-step guide to the installation process.

Your MM/1 kit contains three printed circuit boards. The MM/1 CPU board provides 1MB memory, graphics, color palette, and serial I/O. The MM/1 I/O board includes parallel ports, a stereo sound port, a real-time clock, and sockets for memory expansion. The MM/1 Minibus connects and powers the other two boards.

## Hardware Requirements

Following is a lists of parts you will need to install your MM/1 kit. If you do not already have these parts, please take the time now to purchase them.

- A case
- A power supply for that case
- A 3.5 inch 1.44 Meg floppy disk drive (included with the kit)
- An RGB monitor (Magnavox, Tandy CM-8, or similar)

The following tools will be needed to perform the installation:

- An electric drill
- A 2/16 inch drill bit
- A phillips screwdriver
- A standard screwdriver

## The Case

To properly install the MM/1, you will need some sort of computer case with a built-in power supply. Just about any IBM clone style of case will work. The MM/1 itself has dimensions of 9" x 4 1/2" x 2 1/2", without including the hardware standoffs to separate the PC boards from the bottom of the case. Be careful to insure the case height is adequate. No part of the case may touch the MM/1 circuit boards when it is closed.

The older PC clone cases have ample room for the MM/1 and associated peripheral devices, although the newer "tower" cases look neater and have a much smaller footprint. As long as there is room in the case to mount the MM/1 and the drives, any case will work.

## **The Power Supply**

The power requirements of the MM/1 are very low since almost all the circuit board chips used are low power CMOS devices. Any type of PC clone power supply that will fit in the case you have selected will work just fine since the power connector on the MM/1 is designed to accept the power cables from that type of power supply. Just make sure that the supply includes as many peripheral power connectors as you will need for all floppy and hard disk drives that you plan to install.

## **Floppy Disk Drives**

The MM/1 will accept almost any type of floppy disk drive. However, the OS9/68000 system software shipped with your kit has been saved on 3.5 inch diskettes formatted to 1.44 megabytes. Therefore, you will need to buy at least one of this type of floppy disk drive to install the system software on your machine.

Other types of floppy disk drives that will work correctly are 3.5 inch double-density (720K formatted) drives, 5.25 inch 720K drives, and 5.25 inch low density (360K formatted) drives. Eight inch floppy drives are no longer supported. You can have up to four floppy disk drives on a system, in any combination of supported types.

## **Hard Disk Drives**

The MM/1 is capable of using hard disk drives only with the SCSI (Small Computer Systems Interface) interface. The SCSI standard is rapidly becoming widely used in the industry and SCSI hard drives are becoming very cost competitive with other non-SCSI drives. The SCSI system is actually a high-speed parallel interface arraigned in a "bus" topography. Up to seven SCSI devices can be installed on this bus. Any type of hard disk drive with an embedded SCSI controller will work in any of the common sizes with no known upper limit. Of course, there must be room in the case you choose to mount the hard disk drive you want. The minimum size that is suggested is 30 megabytes.

Certainly, you can run your MM/1 without a hard disk drive, although the enjoyment you receive will be much less, not to mention the additional time you will spend on functions that would be drastically improved with the addition of a hard drive. Any serious system today will include a hard disk.

# Installing Your System

Now that all the major parts of the system have been covered, we can now proceed to the detailed installation instructions.

## Installing Memory

Before you install the MM/1, you will need to install the system's memory. The default memory configuration is 1 megabyte of DRAM. This memory is required and nothing less will work. The MM/1 Extended kit is shipped with 1 megabyte of DRAM already installed. An additional 2 megabytes of SIMM memory can be installed to bring the total memory configuration to 3 megabytes.

## Additional SIMM Memory

Additional memory can be installed easily on the MM/1. Industry standard SIMMs (Single In-line Memory Modules) in several different arrays can be used. Each I/O board includes 2 SIMM sockets. 1 megabyte SIMMs can be installed. You must ALWAYS install 2 SIMMs to fill both sockets.

Along with the default 1 megabyte of system memory, this means there are several memory capacities for the MM/1 as the table below shows:

<u>System DRAM</u>	<u>1 Meg SIMM</u>	<u>Total Memory</u>
1 MB	2	3MB

To install additional SIMM memory, press the SIMMs into the sockets making sure that the chips on the SIMM face to the outside edge of the I/O board. Press the SIMMs firmly into the sockets until the locking pins on the socket snap into the holes on the SIMM body.

If additional memory is installed, you must place a jumper on P7 on the CPU board. Look at the PAL chip to the right of the two ROM's (in the upper right corner of the board) at location U10. To the bottom of this chip are two jumpers. One should already be jumpered (the one to the right closest to the MM/1 Minibus connector). Place a shorting block across the un-jumpered pins arranging it vertically.

## Mounting the MM/1

Before mating the two circuit boards together, you must mount the CPU board in the case. Pick a spot in your computer case where the MM/1 circuit boards will fit. Make

sure the case does not touch any portion of the board or any parts on the board with the case is closed. You may be able to use holes already drilled in the case. Use the drilling template enclosed to select the position. Make sure the power supply cables that will plug into the MM/1 circuit board are long enough to reach to the location of the boards.

You might notice that the backplate to the case will need to be removed so you will be able to access the I/O connectors on the boards. Most PC Clone type cases have a means to remove this backplate. If yours does not, then you will need to remove the backplate, to get to the I/O connectors. Make sure when choosing a mounting location that these connectors are accessible from the rear of the case.

Tape the template to the inside bottom of the case at your chosen location and drill four holes with a 2/16 inch drill bit where they are marked on the template. Make sure the finished holes are free from burrs and no stray metal chips remain in the case when done.

Install the four PC standoffs in the case where the holes were drilled. These are metal standoffs with a drilled and tapped screw hole on one end and a screw post on the other. Install it with the screw post facing up by screwing it to the bottom of the case with screws through the case metal.

Once the standoffs have been mounted, place the CPU board over the them and install the two separator standoffs at the backplate end of the CPU board by screwing them onto the screw post that is protruding through the CPU circuit board. Install the 4-40 nuts over the protruding screw posts at the MM/1 Minibus end of the CPU board. Install the MM/1 Minibus to the CPU board if it is not already plugged in. Do not install the second I/O board at this time.

## **Wiring the Case**

Before proceeding, you might want to take the time to familiarize yourself with the various jumpers and plugs on the CPU board. Use the CPU board location diagram (See Figure 2). Also look over the pages explaining the location and purpose of each jumper or plug.

## **Power Cables**

With the CPU board mounted, you can begin wiring the case. **DO NOT** plug the power cord into an electrical outlet until all wiring is complete and has been double-checked to ensure that it is correct. First, plug the two power cables from

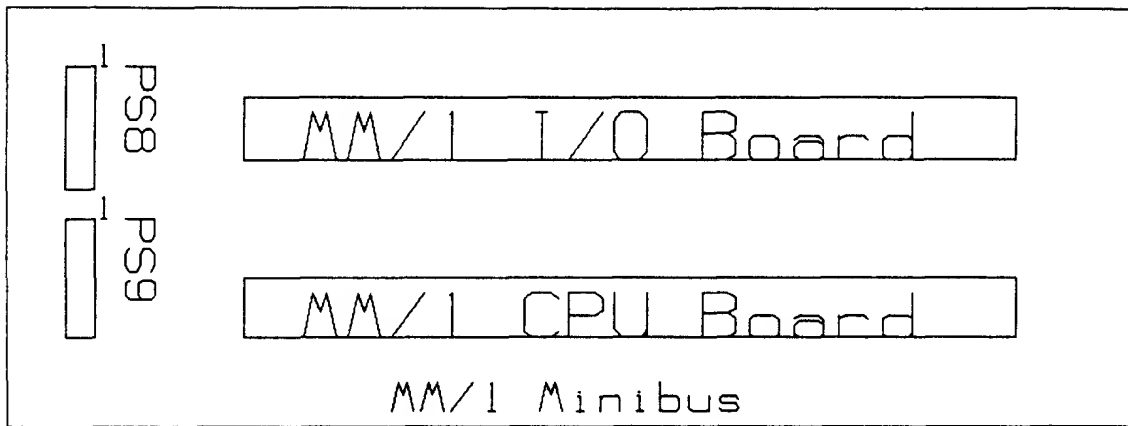


Figure 1: MM/1 Minibus Board Connectors

the power supply into the power connectors on the MM/1 Minibus. Note that the power cables are marked "P8" and "P9". Those cables plug into the corresponding connectors marked "PS8" and "PS9" on the MM/1 Minibus. Note that when the two power cables are correctly installed, the four black wires will be adjacent to each other. Make sure the cables are installed correctly or serious damage could result when power is supplied to the unit.

Some cases have power supply cables that are keyed with raised plastic tabs on the connector to ensure that you do not insert these cables incorrectly. On some cases these tabs are raised high enough that they may interfere with the insertion of the CPU and/or I/O boards. If you need to trim these tabs, be careful to ensure that you do not nick any cables or yourself. Be sure to install the cables correctly, as described above.

## Front Panel Wiring

Many of the newer PC clone cases have a front panel display area where one or more switches and lights are located. Of interest to you during the installation of your MM/1 are the power indicator LED, the hard disk drive indicator LED, the main power switch, and the reset button. If your case does not have any of these items, you can still install your MM/1. None of the above items are required for operation. If there is no front panel main power switch, then a switch is normally installed on the power supply itself.

To connect the front panel power LED and reset switch, refer to the CPU



location diagram and find P3 on the diagram and the CPU board. It is located along the top edge of the board about midway. Notice that P3 is broken into two connectors--one two-pin and one three-pin. The two-pin connector is for the reset button and the three-pin is for the power LED.

Top of PC Board

-----  
Jumper P3: | \* \* \* - - \* \* - |  
-----

## Power Reset

To make the connection, simply plug the reset button connector onto the two-pin connector and the power LED connector into the three-pin. If your case did not come with plugs already fitted to the end of these wire, you will either have to buy and fit them yourself or forego having these connections installed.

## System Check-out

Before continuing, please consult the page describing the jumpers on the CPU board and make sure they are all set correctly. Your MM/1 was shipped with the default jumper settings, so changes would only be needed if you were installing the boards with non-standard equipment. Also make sure you have the 1 Meg System Boot Disk that was shipped with your MM/1 Kit on-hand.

Once you have verified all your jumpers and connections, you should install the 3.5 inch floppy disk drive following the manufacturer instructions. With the drive installed, connect the ribbon cable to the MM/1 at P14. Make sure pin 1 on the cable, usually marked with a red strip, is lined up with pin 1 on P14. Pin 1 is on the end furthest from the MM/1 Minibus connector.

When installing the floppy drive in the case, be sure not to screw in the mounting screws too deeply. Some manufacturers' mounting screws are long enough to interfere with the proper rotation of the floppy disk drive platter. Before installing your floppy drive, check the length of the mounting screws and replace them with shorter screws if necessary.

Most floppy drives can be configured for use as /d0, /d1, /d2, or /d3, and most are shipped from the factory set for use as drive 1. To use a floppy drive as /d0, /d2, or /d3, you must change the configuration. Some drives are configured with jumpers on the floppy drive. Others are configured by a drive selector switch on the floppy drive. Drives purchased from Interactive Media Systems, Inc. include configuration instructions. Consult with your dealer about

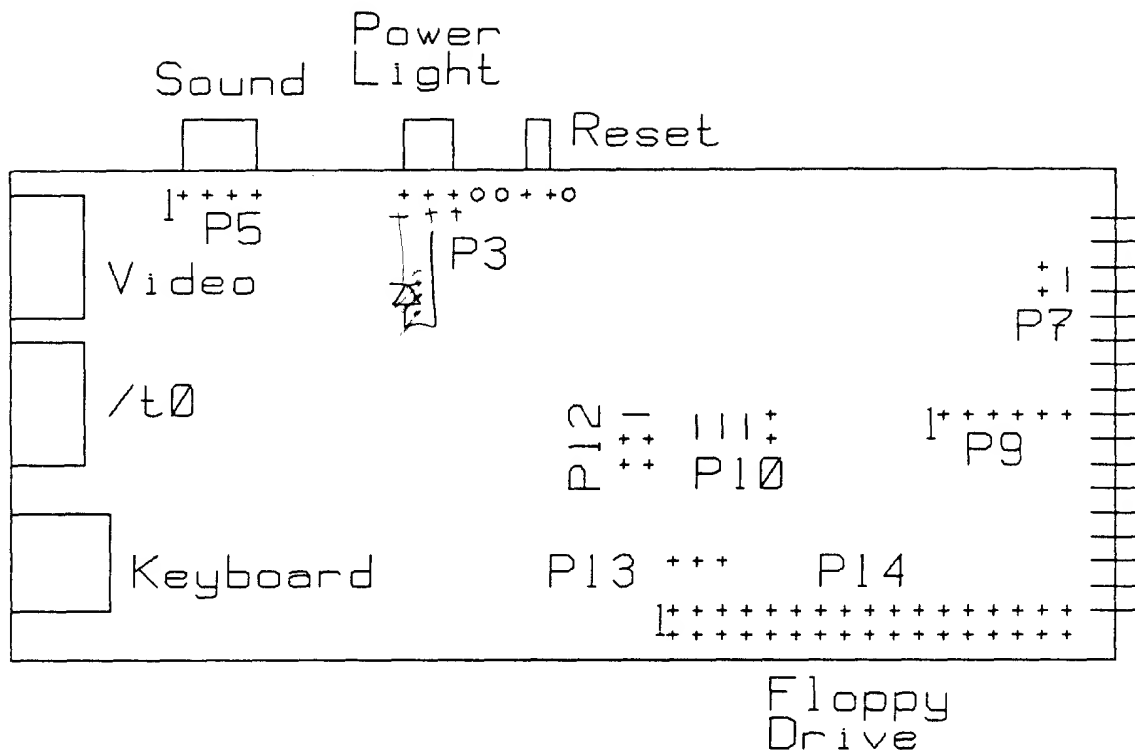


Figure 2: MM/1 CPU Board Jumper Locations

configuring floppy drives purchased elsewhere.

You are now ready to make the first systems check. Setup the monitor close to the CPU case and make sure it is plugged into an AC outlet. Connect your monitor to the video connector P1. Plug in the AC power cable to the power supply and turn on the power.

You should get a blue screen on the monitor in a few seconds. If not, turn off the power immediately! If the blue screen comes up, check to see if the floppy disk drive selection light is turned on. If it has, then insert your 1 Meg System boot disk into the drive. The system should now boot. The disk drive light will go out and there will be a short pause. You may see some patterns appear at the bottom of the monitor screen. If all works correctly, the initial boot-up screen will appear followed by the \$ shell prompt.

## Dealing With Problems

If the initial test does not work and nothing appears on the monitor screen, follow the steps below to try and correct the problem:

1. **TURN THE POWER OFF!**
2. Check the power connectors on the MM/1 Minibus
3. Be sure that the video cable is connected
4. Remove all case front panel connectors and the floppy cable
5. Turn on the power again and see if the blue screen appears
6. If it does, turn off the power and re-connect the front panel connectors and try it again
7. If the screen appears again, turn the power off, and connect the floppy disk cable
8. Turn the power on again
9. If nothing happens, either the floppy drive cable, the drive itself, or the MM/1 floppy interface is bad

If the blue screen appears but the drive light does not come on, or the system will not boot:

1. Make sure all cables are installed correctly
2. Make sure the disk drive is set for drive 0 (consult the manufacturer documents)
3. If the drive light comes on and stays on when power is applied, the drive cable is either installed wrong, the cable is bad, the floppy drive is bad or the MM/1 is not working correctly
4. You tried to boot the system with the wrong boot disk. Use the 1 Meg System Boot disk
5. If you still cannot get the drive to work, call IMS for support

## **I/O Board Installation**

If you are installing additional SIMM memory, make sure the jumpers on P7 (CPU Board) are set correctly before installing the I/O board. A jumper should be installed on

the two header pins closest to the MM/1 Minibus. The jumper should be installed parallel to the MM/1 Minibus. Make sure that the power is disconnected when installing jumpers. Install any additional SIMM memory before mounting the I/O board since it will be much easier to insert the SIMMs with the board out.

Install the I/O board on the spacers sticking up from the CPU board. If the MM/1 Minibus is already plugged in, make sure the I/O board is plugged into it snugly. Install the screws into the posts to hold the I/O board in place and you are finished.

To install a hard disk drive in your case you need to refer to the manufacturers documentation. Make sure the drive is setup as a SCSI device zero (0) and no parity checking is selected. Usually, these options are set on the drive using jumpers. Consult the drive docs. Make sure you mount the drive in a position where the SCSI connector cable can reach the MM/1 circuit boards.

Plug the 50-pin SCSI cable you should have received with the drive into the SCSI connector on the I/O board. The cable is keyed so it will only go in one way. DO NOT force it into the connector. Plug the other end of the cable into the SCSI hard drive which is also keyed.

## **Second System Check**

Once you have the I/O board successfully installed, you can power up your MM/1 and reboot. If you have installed additional SIMM memory, you must boot with the 3 Meg System Boot disk. If not, then use the 1 Meg boot disk again. If you have trouble at this point, check the previous lists above for any errors you might have made. If everything checks out correctly, and you did not have any problems booting with a single board system, then either something is wrong with the I/O board or the way you installed it. Contact IMS for help.

## **Some Additional Information**

The following sections are not meant as a detailed operating manual for the MM/1. This information is included only as a guide in setting up your MM/1 Kit. A detailed hardware manual will soon be available from IMS covering all aspects of the MM/1 computer.

### **Formatting Hard Drives**

If you have installed a hard disk drive, you must format it before it can be used. However, formatting hard drives is different with the MM/1 than what many users might be used to from previous experience with a CoCo hard drive system or an IBM clone system.

*The default device descriptor for hard disks is set to prevent accidentally formatting the hard disk. When you type :*

```
dmode /h0
```

*you will then see:*

```
drv=00 stp=00 typ=80 dns=00 cyl=026C sid=04 vfy=01
sct=0011 tos=0011 ilv=03 sas=11 tfm=00 toffs=00
soffs=00 ssize=0200 cntl=0003 trys=07 lun=00
wpc=0000 rwr=0000 park=0000 lsnoffs=00000000
```

*The cntl parameter must be set to 002 to enable formatting. To do this, type:*

```
dmode /h0 cntl=002
```

*Then you may proceed with formatting the hard disk as described in this manual. DO NOT save the changed hard drive descriptor. When you reboot the MM/1 the descriptor will default to cntl=003, preventing accidental hard disk formats.*

First, the hard drives used by the MM/1 are SCSI drives.

Until recently, SCSI drives were only used in Apple MacIntosh computers, but now are finding their way into the IBM clone world. The biggest difference between a SCSI hard drive and the more widely known ST406 interface hard drives is that the drive itself is "intelligent". What this means to you the user, is that you do not need to know all the many parameters of the SCSI hard disk drive to format it. All you need to know is the total number of sectors on the drive.

For example, the following drive types and their respective number of sectors was taken from a Seagate handbook:

<u>Drive Type</u>	<u>Nbr of Sectors</u>	<u>Capacity</u>
ST138N	63,139	32 Meg
ST157N	95,015	48 Meg
ST225N	41,720	21 Meg
ST251N	84,254	43 Meg
ST277N	126,790	64 Meg

So, to correctly format a SCSI drive, all you need to tell the format utility is the number of sectors on the drive. However, the OS9/68000 format utility uses cylinders and heads as drive size parameters. So which is right?

First, you call the format utility thusly:

```
format -nvnp -v=Test /h0
```

The format utility will do a logical format of the hard drive creating the sector allocation table and right the information in logical sector zero (LSN0). It will return, among other things, the total number of sectors created on the drive. This is the number we are interested in.

If the number of sectors returned is different than the total number of sectors on your hard disk, then all you need to do is use the DMODE utility to change ANY parameter about the drive size (such as number of cylinders, number of heads, number of sectors per track) to increase or decrease the number of sectors that will be formatted on that drive until it equals the number of actual sectors.

For example, you have a ST225N drive. You run the format utility as shown above and it returns 41,680 sectors. You would not need to change anything since the parameters are set correctly. However, if you have an ST251N drive, you would need to DOUBLE the number of sectors that the format utility will create. Therefore, you could take the number of cylinders OR the number of heads and double that value. Using the DMODE utility, you might try:

```
dmode /h0
```

```
drv=00 stp=00 typ=80 dns=00 cyl=026C sid=04 vfy=01 sct=0011  
tos=0011 ilv=03 sas=11 tfm=00 toffs=00 soffs=00 ssize=0200  
cntl=0003 trys=07 lun=00 wpc=0000 rwr=0000 park=0000  
lsnoffs=00000000
```

We want to double the number of heads (sides) to double the number of sectors:

```
dmode /h0 sid=8
```

```
drv=00 stp=00 typ=80 dns=00 cyl=026C sid=08 vfy=01 sct=0011  
tos=0011 ilv=03 sas=11 tfm=00 toffs=00 soffs=00 ssize=0200  
cntl=0003 trys=07 lun=00 wpc=0000 rwr=0000 park=0000  
lsnoffs=00000000
```

Alternatively, we can double the number of cylinders:

```
dmode /h0 cyl=04d8
```

```
drv=00 stp=00 typ=80 dns=00 cyl=04D8 sid=04 vfy=01 sct=0011  
tos=0011 ilv=03 sas=11 tfm=00 toffs=00 soffs=00 ssize=0200  
cntl=0003 trys=07 lun=00 wpc=0000 rwr=0000 park=0000  
lsnoffs=00000000
```

Once we have the number of cylinders that format will create matching the total number of sectors actually on the hard drive, you can then format the drive without any command line options. This will then perform a physical format, ask you for a volume name, and then optionally perform a verify (which you will want to do with a new drive).

Finally, you DO NOT need to save the change hard drive descriptor to be able to access that drive in the future. As was mentioned before, SCSI hard drives are "intelligent" drives.

## Using Two Hard Disks

The SCSI bus on the MM/1 is designed to easily add additional devices to expand your system. Adding a second hard drive is therefore very easy. The first hard drive on the system should have been selected as SCSI device zero (0). Your second hard drive should then be selected as SCSI device one (1). Consult the drive documentation to see how this is done.

**MAKE SURE TO REMOVE TERMINATING RESISTORS FROM ALL BUT ONE HARD DRIVE.** This is imperative if you do not wish to severely damage or destroy your MM/1. Only one drive can have terminating resistors on it--it doesn't matter which one.

After mounting the second drive in your case, you'll need to get a new cable that includes an additional 50-pin header connector to plug into the second drive.

Once the drive is mounted, boot the system. If everything was set up correctly, it will boot as before. If the system does not boot, you probably didn't set the second drive to SCSI device one, and it thinks it is device zero, so the system is trying to boot from an empty drive. This all depends upon where the second drive appears to the bus.

Once your system has booted normally to the first hard drive, load the /h0 descriptor located in the /RBF directory of Distribution Disk #6 (Boot Modules). Then format the second drive as you did the first, using /h1 as the device name.

You should now create a new boot disk that includes the /h1 modules. The /LISTS directory of Distribution Disk #6 contains a bootlist for generating a hard disk boot. The bootlist for systems with 1 Megabyte of memory is "boot.1mhd". The bootlist for systems with 3 Megabytes of memory is "boot.3mhd". Edit the correct bootlist file and insert the path name of the /h1 module right after the path name of the /h0 module. Save the file.

Within the /h0/BOOTMODS/LISTS directory, and with a BACKUP copy of your old boot disk in drive /d0, now execute the following:

```
os9gen /d0 -z=<filename> -eb=100k
```

If you are using /d0/BOOTMODS/LISTS, then you can execute the following:

```
chx /d0/cmds
chd /d0/bootmods/lists
iniz /r0
os9gen /r0 -z=<filename> -eb=100k
```

When disk activity stops, remove the Distribution Disk from /d0, insert a BACKUP copy of your boot disk in drive /d0 and type:

```
copy /r0/os9boot /d0/os9boot
os9gen /d0 -q=os9boot
```

Now reset your MM/1. Your second hard disk drive should now be recognized by OS-9/68000 so you can use it. If you have problems, call Interactive Media Systems, Inc.



# Jumper Settings

## Processor Board

<u>Jumper</u>	<u>Settings</u>	<u>Action</u>
P5	None	Not a jumper, but a sound output location. Pin 1 is sound-out, pin 2 grounded. Same as sound output on the CM-8 monitor.
P8	OPEN	Sets logic of VSYNC* and HSYNC* to normally high or low. Depends upon monitor.
P4	NOT USED	Tap into video circuits.
P3		Power light and Reset
P15		
P6		Keyboard connector
P12		
P10		
P13		Sets pin 2 of floppy drive to high or low depending on if the type of floppy drive needs it set
P14		Disk Drive connector
P9		High Speed serial I/O
P7		Memory jumpers

## I/O Board

<u>Jumper</u>	<u>Settings</u>	<u>Action</u>
P5	1 < > 2 for P 3 < > 4 for P1	Toggles linefeed on or off
P11	3 < > 4	Adjusts refresh rate
P7	NONE	SCSI activity light

J1	1 < > 2	Selects SCSI power from the bus or from the I/O board. Only used if another SCSI MASTER is on the bus.
H1/H2	H1[4] < > H2[4]	Selects I/O wait states